

CLAIMS:

1. An ultrasonic measurement system for determining flow of gas or low density fluid in a conduit, such system comprising  
a first transmitter receiver pair secured to define a first ultrasonic signal path across fluid flowing in the conduit,  
a second transmitter receiver pair configured to define a second ultrasonic path across fluid flowing in the conduit,  
said second transmitter receiver pair being mounted so that the second path is antiparallel to the first path and spaced a fixed distance therefrom, and  
a processor operative to correlate a tag-modulated output signal of said first pair with a tag-modulated output signal of said second pair to determine a time interval representative of flow.
2. The system of claim 1, wherein said first pair operates at a different frequency than said second pair.
3. The system of claim 1, operating in a frequency range above 100 kilohertz.
4. The system of claim 3, wherein said frequency range lies above approximately 900 kilohertz.
5. The system of claim 1, wherein said first pair operates at a frequency different than frequency of operation of said second pair, and received signals are demodulated at their transmission frequency.
6. The system of claim 5, wherein said first pair operates at a frequency within approximately ten percent of said frequency of operation of said second pair.
7. The system of claim 5, wherein said first pair and said second pair operate in a continuous mode.

8. An ultrasonic measurement system for measuring flow of gas in a conduit, such system comprising

first and second transmitter receiver pairs defining first and second transit paths across a conduit, the second transit path being anti-parallel to the first transit path, a signal processor for processing signals received along said first and second paths,

a correlator for determining a time interval between correlated tag modulated signals on said first and second paths.

9. The system of claim 8, wherein said transducers are coupled to a steam pipe of a building heating system.

10. The system of claim 8, wherein said transducers are attached to a process feed gas pipe of a chemical plant.

11. The system of claim 8, wherein said transducers are attached to a conduit having a nominal diameter under about two inches.

12. The system of claim 8, wherein at least one of said transducers is attached to a conduit by clamp-on.

13. A method of measuring flow of steam or gas in a conduit, such method comprising the steps of

providing a first transmitter/receiver pair defining a first signal path through fluid in the pipe such that a first receiver output is modulated by tags in the fluid

providing a second transmitter/receiver pair defining a second signal path through fluid in the pipe such that a second receiver output is modulated by tags in the fluid,

the second signal path being anti-parallel to the first path, and correlating the second receiver output with the first receiver output to determine flow rate.

14. The method of claim 13, further including the steps of operating the first transmitter/receiver pair at a first frequency and operating the second transmitter/receiver pair at a second frequency different from the first frequency, wherein the first frequency is sufficiently high to be well modulated by the tags, and the second frequency is close to the first frequency.

15. The method of claim 13, wherein the steps of providing transmitter/receiver pairs include providing clamp-on transducers.

000001-103000

add 0.5